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ABSTRACT

The effects of season (November vs February vs May) of disking on plant composition were evaluated on a longleaf pine (*Pinus palustris*) site in southeastern Louisiana during 1986–1990. Almost 150 species of plants were recorded in the fallow disked plots during 3 sampling years. Disked plots, compared to native upland pine sites, had a lower abundance of broomsedges (*Andropogon* spp.) and wiregrasses (*Aristida* spp.), more bare ground, and more early seral plants such as 3-seeded mercury (*Acalyphya* spp.) and poor-joe (*Diodia teres*). Legumes were reduced or stable under all disking regimes and disking did not increase the quantity of partridge pea (*Cassia nictitans* and *C. fasciculata*) or ragweed (*Ambrosia artemisiifolia*), as frequently reported.

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INTRODUCTION

Northern bobwhite (*Colinus virginianus*) populations in Louisiana have declined since they peaked shortly after the turn of the century (Louisiana Department of Wild Life and Fisheries [LDWF]1948); populations are perceived to be at all-time lows. Farmlands in Louisiana historically supported the densest populations, but now generally offer marginal to very poor quality habitat due to large-scale clean farming, intensively managed improved pastures, and overgrazing. Pinelands, though not as productive for bobwhites as they were 40 years ago, presently support the majority of the quail (Louisiana Department of Wildlife and Fisheries unpublished data, W-55–10, V-I) and, as such, offer the greatest recreational opportunities.

Fallow disking in pine woodlands has long been acknowledged as a beneficial bobwhite food management technique. However, managers do not agree on the optimum timing for this activity. Stoddard (1931: 365) stated that disking should occur from November through mid-March. Rosene (1969:318) suggested disking after 15 September but before April. In Louisiana, Brunett (1975) advised to disk as soon as possible in the spring until 15 August, while Prickett (1981) indicated that disking "should be completed by late winter before spring growth begins." The objective of this investigation was to evaluate vegetation response to disking in different seasons.

STUDY AREA

The Sandy Hollow Quail Research and Development Area (hereafter Sandy Hollow), located in Tangipahoa Parish in southeastern Louisiana, is a 1,234 ha longleaf pine site that was purchased by the LDWF in 1986. Most of the area was clearcut during the 1970's and early 1980's, but longleaf regeneration (grass stage to sapling) occurs across the area. Like many southeastern pinelands, the area also had a long history of cattle grazing. Nevertheless, the herbaceous cover on Sandy Hollow is considered to be representative of a quality longleaf pine system due to the absence of large-scale site disturbance associated with agriculture and a long history of annual burning (by prescription and by arson) (Louisiana Department of Agriculture, Office of Forestry, personal communication). Upland pine and upland drain vegetation dominate Sandy Hollow and are where most bobwhites are located. Common grasses and sedges include broomsedge, panic grasses (*Panicum* spp.), nut rushes (*Scleria* spp.) and wiregrass (LDWF unpublished data, W-55, VI-I Final Report). Pencilflower (*Stylosanthes biflora*) is the predominant legume. The topography of the area is characterized by gently to moderately rolling hills. Soils are mostly sandy and silt loams of low fertility and mild to moderate acidity, with strongly acid subsoils.

Since it was acquired by the LDWF, Sandy Hollow has been managed intensively for northern bobwhites to accommodate quail hunting and bird dog field trials. Most of the area continued to be prescribed burned annually with 0.5–2 ha "cover islands" about every 40 ha. However, because the area is an example of native and mostly undisturbed longleaf pine flora, development was somewhat restricted until the extent of rare plants was better understood. With this in mind, a goal of only 5–10% disturbance was initially established for the area. Within the upland pine habitat, approximately 250 rectangular food plots totaling 25 ha and 50 km of strip food plots totaling about 15 ha were planted. Food plots were generally a mixture of 6 parts Egyptian wheat (*Sorghum vulgare*), 3 parts browntop millet (*Panicum fasciculatum*) and 1 part Kobe lespedeza (*Lespedeza striata* var. *striata*) planted at about 10 kg per ha.

METHODS

Study Design

The effect of disking in different seasons (November, February and May) was evaluated for a 3-year period. Three sets of 3 disking plots, each 20 m × 50 m (0.1 ha), were established on 1 section of Sandy Hollow. Within each block, a disking month was randomly assigned to each plot the first year and maintained throughout the study. Plots were thoroughly disked (approximately 5 times) the first year with a 2.1-m offset disk. In subsequent years, plots were double-disked.

Vegetation Sampling

Vegetation was sampled using 2 methods. The first method closely followed that used by Walker and Peet (1983) to determine vegetation composition. Ground cover vegetation presence was recorded on 10 0.5-m × 0.5-m subplots located at random distances along either side of the plot centerline. The potential locations of the ground cover subplots were determined by dividing the centerline into 200 0.5-m long segments (100 along each side of the centerline) and randomly selecting a sample from among these potential subplots. The second method consisted of sampling vegetation along either side of the centerline using the loop intercept method (Parker 1951). A 2-cm diameter loop was placed at 200 randomly selected points. Only vegetation at the ground level was recorded as within the sample loop. Vegetation sampling was conducted in early July. Data from another study on Sandy Hollow conducted during 1987 and 1988 provided comparative data (LDWF unpublished data, W-55, VI-I Final Report). The same techniques were used in that study to sample 6 randomly located upland pine plots managed by annual prescribed burning.

Data Analysis

Analysis of variance was performed on loop sampling data (count data) with SAS software using a split plot in time design to determine the impact of disking period on quail food plants and non-food plants collectively. Treatments (disk date) were applied to plots within blocks (whole plot) and the split plot effect was years. The model was reduced when possible ($P < 0.05$) and the mean square error used to test the disk date and year responses in the final model were disk date by block and the full model, respectively. Least square means and associated standard errors were used to determine differences among treatments and years when appropriate. A quail food plants list was developed using Reid and Goodrum (1979), Wycoff (1964), Rosene and Freeman (1988) and unpublished LDWF data.

RESULTS AND DISCUSSION

The initial study design was to treat plots for 3 consecutive years. However, due to wet weather in the fall of 1988, no disking was conducted that period. As a consequence, plots were disked in 1986–87, 1987–88 and 1989–90. Almost 150 species of plants were recorded in the fallow disked plots during the 3 sampling periods (July 1987, 1988 and 1990) and 26 species/genera were recorded in ≥20% of the species composition plots (Table 1). Disked plots, compared to the native vegetation plots, contained a lower abundance of grasses such as broomsedge and wiregrass, an increase in bare ground, and more early seral plants such as 3-seeded mercury and poor-joe. Nevertheless, broomsedge occurred in about 65% of the November and February disked composition plots. Panic grasses were the most frequently recorded species in disked and native upland composition plots (≥90%).

Table 1. Percent occurrence for plant species commonly found on composition plots sampled in July on the Sandy Hollow Quail Research and Development Area, Tangipahoa Parish, Louisiana.

Species	Month of disking: November	February	May	Native upland
Acalyphya spp.	70	56	24	4
Andropogon spp.	64	62	22	92
Aristida spp.	7	11	3	52
Aster spp.	88	77	18	71
Boltonia spp.	32	26	0	22
Crotalaria spp.	54	29	2	22
Croton spp.	22	7	14	22
Cuphea carthegensis	22	7	14	0
Desmodium spp.	22	20	8	33
Diodia spp.	47	68	52	12
Eupatorium spp.	49	62	12	32
Gnaphalium spp.	32	36	2	4
Helianthus spp.	29	60	4	32
Hypericum spp.	43	23	2	9
Hypoxis spp.	30	32	42	43
Lespedeza spp.	28	14	2	24
Linum spp.	37	6	0	2
Panicum spp.	90	98	90	95
Paspalum spp.	58	61	21	20
Polypremum spp.	22	34	28	1
Rhus copilliana	9	22	1	3
Rubus spp.	33	39	11	17
Scleria spp.	54	66	23	56
Solidago spp.	37	27	22	40
Stylosanthes biflora	61	67	32	75
Strophostyles spp.	9	32	6	17

Three taxa (panic grasses, 3-seeded mercury, and aster [*Aster* spp.]) occurred in the November disked plots ≥70% while panic grasses and aster and panic grasses were recorded in ≥70% of the February and May disked plots, respectively. Four taxa (panic grasses, broomsedge, pencilflower, and aster) were present in ≥70% of the native upland pine plots.

Loop sampling data were collectively analyzed as food plants and non-food plants because of the sparseness of the data set. Disk date ($F = 11.69$, 2,4 d.f., $P = 0.021$) and year ($F = 7.59$, 2,26 d.f., $P = 0.005$) were significant for food plants. Quail food plants were greater ($P < 0.03$) on November ($\bar{x} = 44.9$, SE $= 4.7$) and February ($\bar{x} = 35.7$, SE $= 4.7$) disk plots than May disk plots ($\bar{x} = 13.7$, SE $= 4.7$) (Figure 1). Grasses (sedges included) predominated in loop sampling regardless of disk date. Grasses accounted for at

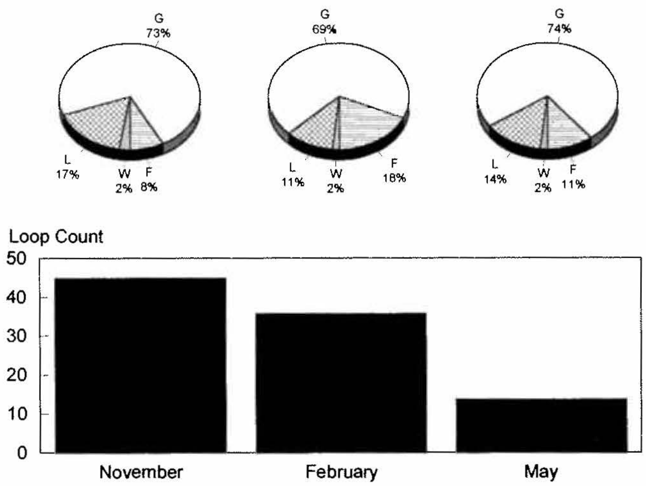

Fig. 1. Loop sampling count data for quail food plants in disked plots by month and percent contribution by plant groups (F = Forbs, G = Grasses, L = Legumes, and W = Woody) on the Sandy Hollow Quail Research and Development Area, Tangipahoa Parish, Louisiana.

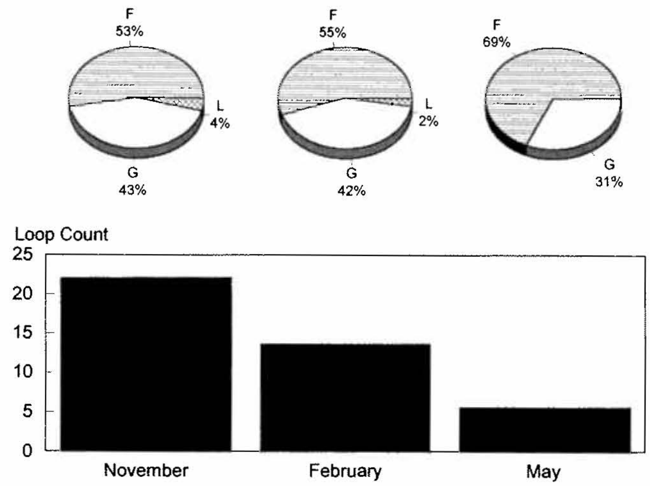

Fig. 2. Loop sampling count data for quail non-food plants in disked plots by month and percent contribution by plant groups (F = Forbs, G = Grasses, L = Legumes, and W = Woody) on the Sandy Hollow Quail Research and Development Area, Tangipahoa Parish, Louisiana.

least 66% of the loop counts (range 69%-74%). Legumes were present in 11–17% of the counts while forbs represented 8–18% of the loop sample vegetation and woody food plants averaged <3%.

Disk date (F = 19.26, 2,4 d.f., P = 0.009) and year (F = 3.63, 2,26 d.f., P = 0.050) were significant for non-food plants. Forbs outnumbered grasses and legumes regardless of disk date (Figure 2). Non-food forbs accounted for 53–69% of the loop counts. Non-food grasses accounted for 31–43% of the loop counts while legumes represented 0–4% of the samples. No woody non-food plant was recorded.

A somewhat unexpected result of disking was the apparently stable to reduced abundance of quail foods as compared to native upland pine plots. Of particular note was the lack of response by legumes. Prevalence based on composition data suggests that only wild bean (*Strophostyles* spp.) increased while lespedezas (*Lespedeza* spp.), beggarticks (*Desmodium* spp.), pencilflower and milk pea (*Galactia* spp.) decreased, or at best were stable. Partridge pea and ragweed were not recorded in either the loop or composition sampling in disk plots. However, they also were not detected by either method during upland pine sampling. Landers and Mueller (1989:23) indicated that the percent coverage on Tall Timbers Research Station's December disk plots was about 10% for partridge pea and 30% for ragweed.

Stoddard (1931:365) stated that vegetation response to fallow disking was dependent on season of disking. He further reported that seed bank on the site was also extremely important in determining the response. Seed sampling on Sandy Hollow indicated that partridge pea was largely absent from upland pine plots (LDWF unpublished data, W-55-VI-I Final Report). Fallow disking has not been as effective as initially expected on some pine sites in Mississippi (W. Burger, Department of Wildlife and Fisheries, Mississippi State University and L. Brennan, Tall Timbers Research Station, personal communication). They hypothesized that the lack of agrarian history and past overgrazing on the sites may have resulted in a limited seed bank of desirable plants. Not only does Sandy Hollow not have a history of agriculture, it likely had a history of overgrazing. In addition, soils at Sandy Hollow are generally characterized by slightly to moderately acid soils with strongly acid subsoils. As a rule, low pH soils support fewer legumes than higher pH soils, such as those frequently associated with many of the better quail areas in the Southeast. The lower pH of Sandy Hollow soils may have also contributed to the lower natural seed bank.

MANAGEMENT IMPLICATIONS

The lack of expected legume response does not negate the benefits of fallow disking. Fallow disking created edge, travel lanes and generally more open conditions for northern bobwhite habitat use. Competition reduction may also enhance seed production of desirable plants and seeds produced should be more readily available because of the limited dead leaf litter on the ground. November and February provided the greatest overall benefits. Fallow disking can be incorporated into a site's prescribed burning program with disked strips serving as firebreaks. In this instance, the season of burning may dictate the season of disking.

Quail managers are encouraged to develop similar trials on their areas to further the understanding of fallow disking. Results of this study and those observed on at least 1 site in Mississippi suggest that impacts of fallow disking may differ significantly from those reported from the Thomasville-Albany, Georgia area. As a consequence, traditional food plots and plantings may be more important in habitats with little history of agriculture, a long history of overgrazing or lower pH soils than in traditional quail plantation regions of the Southeast because of the lack of legume and ragweed response to fallow disking. DeVos and Mueller (1993) found managed old field sites with an abundance of legumes to be important brood rearing areas. With this in mind, managers on areas with intact native forest ground cover may want to incorporate legumes into food plots, particularly partridge pea, to facilitate conversion to fallow disking management regimes.

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